TRANSLATION FROM FRENCH

European Patent Office

EP 0 696 432 A1

EUROPEAN PATENT APPLICATION

Publication date: **February 14, 1996** **Bulletin 1996/07**

Int. Cl.^{6}: **A47L 13/16**

File number: **95401876.8**

Filing date: **August 10, 1995**

Treaty nations cited:
DE ES FR GB IT

Priority: **August 12, 1994 FR 9409990**

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Scrubbing Element Made of Porous Material, Scouring Composite, Methods for Their Preparation

The present invention concerns a single-piece scouring element (1) made of thermoformable porous material of the alveolar material type or woven or nonwoven textile, having, on at least one (1') of its so-called work faces (1', 1"),

at least one relief pattern (3), which occupies only part of the surface of said face (1'). Characteristically, said pattern (3), without a sharp edge at its tip, has a porous structure charged at least superficially with a scouring composition, whereas the surface of said face (1') not occupied by said relief pattern (3), defining at least one zone (4), has a densified structure essentially devoid of pores and charged at least superficially with said scouring composition.

The invention also concerns a scouring composite that incorporates in its structure such an element (1) and the methods for preparation of said elements (1) and the composite.

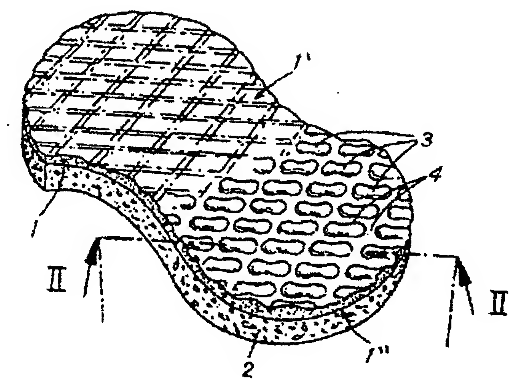


Figure 1.

Description

The present invention concerns:

- a single-piece scrubbing element made of porous material;
- a scouring composite, incorporating such an element in its structure;
- methods for preparation of said element and composite.

The element of the invention is based on a porous material of the synthetic foam type, a cellulose product (sponge, sponge cloth) or woven or nonwoven textile. It is provided with at least one profiled work surface. It is particularly useful in cleaning and/or scouring operations.

Foam elements and profiled sponges have been described according to the prior art, especially in application FR-A-2 302 711 and its Certificate of Addition FR-A-2 340 711, as well as Application FR-A-2 347 913. Said foam elements and sponges have protrusions with sharp edges on one of their faces. At the level of said protrusions, at their tip, i.e., over their entire height and at their base, one can find a material with polishing action or an abrasive material. Sculpturing of the surface to obtain said protrusions by the described cutting or thermoforming methods (methods that remove material and embrittle said surface) is accomplished on the "crude" substrate not covered with a coating that encloses the material with polishing action or abrasive material. It preserves a certain porosity for said surface, both at the level of the protrusions and at the level of the grooves between protrusions. It is stressed here that, to the extent to which the protrusions with sharp edges must be obtained, the employed thermoforming on the crude substrate must be under very special conditions. It is appropriate to operate at high temperatures to melt, volatilize the material without its actual compression. Such compression would inevitably involve the destruction of the sharp edges and the appearance of "rounded" patterns in place of the protrusions with sharp edges.

Such "rounded" patterns are found on the element made of porous material according to the present invention. They are generated by thermoforming or thermoembossing, during which the crude substrate or noncrude substrate is actually compressed. This is explained in detail subsequently in the present description.

According to the prior art, nonwovens have also been profiled by thermoforming, to produce, in particular, imitation leather (FR-A-2 250 846) or shock absorbing materials (US-A-3 977 928). To the knowledge of the applicant, this technique has thus far not been used to produce scrubbing utensils.

According to its first object, the invention concerns a single-piece scrubbing element made of thermoformable porous material of the alveolar material or woven or nonwoven textile type. Said element has, on at least one of its so-called work faces, at least one relief pattern that occupies only part of the surface of said face. Characteristically:

- said relief pattern has a porous structure, charged at least superficially with a scouring composition and not having sharp edges at its tip;
- the surface of said face (the face carrying the relief pattern) not occupied by said relief pattern has a densified structure essentially devoid of pores and charged at least superficially with said scouring composition. This surface defines at least one zone.

The element of the invention is a single piece. It has at least one profiled work surface. It does not consist of a built-up surface. It was generated by thermoforming of said element. This is explained subsequently in the present text.

The base substrate of the element of the invention can consist of any type of porous material that possesses a certain flexibility. This flexibility is required by the use of said element. Used by itself or in a composite, it is called upon to be deformed to ensure its scrubbing function, especially in corners, in locations difficult to reach, within kitchen utensils or tableware, etc.

Said substrate, however, must be thermoformable, and this will be easily understood by one skilled in the art. The base material(s) forming it or the mixture of said material(s) with a product of the binder type must be able to be thermoformed to produce a profiled work surface(s).

Said base substrate can consist, in particular, of an alveolar material or textile, woven or nonwoven.

According to a first variant of the invention, it consists of an alveolar material. In the context of this variant, it can consist of a block of synthetic foam. Any type of synthetic foams,

flexible and thermoformable, are suitable. Synthetic foams that are perfectly suited, for example, are based on polyester-urethanes. Other foams, not very thermoformable or not thermoformable at all, for example, polyether-urethane foams, can also be suitable to the extent that they are made thermoformable by impregnation with a binder. It can also consist of a block of alveolar cellulose. An artificial sponge is advantageously involved. The intervention of a natural sponge is not ruled out, but it is known that such sponges are a priori reserved for other applications. Said base substrate therefore advantageously consists of a sponge or sponge cloth, as obtained by the viscose process (thermoformable in the presence of moisture).

According to a second variant of the invention, said base substrate consists of a woven or nonwoven textile. Any type of flexible and thermoformable textiles are suitable. Appropriate textiles are those based on synthetic, artificial or natural fibers, or based on mixtures of said fibers. Preferably, the base substrate of the scrubbing element according to the invention consists of (or mostly contains) thermoplastic synthetic fibers (i.e., thermoformable), especially flexible when their titer is less than 100 dtex. It can also consist of natural cellulose fibers, like cotton, and/or artificial cellulose fibers, like viscose. Such cellulose fibers are thermoformable in the presence of moisture.

It is noted in general that woven or nonwoven textiles are often sized, coated or impregnated with a material, whose function is to be a binder of the fibers forming it. The intervention of such a binder can make a textile based on threads (or fibers) that are not thermoformable themselves perfectly thermoformable.

The element of the invention has, on at least one of its faces, a pattern or patterns and zone or zones with the aforementioned characteristics. Said characteristics are detailed below. They derive directly from the process employed to generate said pattern(s) on the surface of said element.

The relief pattern(s) has/have a porous structure charged with a scouring composition and no sharp edge at the tip. "Rounded" pattern(s) is/are involved, which preserve a porous structure and are coated at least superficially with a scouring composition. Said coating can have been carried out to variable depth. Said scouring composition can also be found only on the upper part of the pattern(s) rather than in bulk. It was already mentioned here that this coating of the element with said composition is used according to the invention after or before generation of the relief pattern(s) by thermoforming.

As regards the composition of this scouring composition, it is not original in itself. Said composition is based on a binder – resins or two-component glues, like some polyurethane glues; single-component resins or glues; latex, which is capable, under certain conditions (under the influence of heat, UV, IR radiation, etc.), of crosslinking, to form part of the base substrate. For crosslinking under the influence of heat, a catalyst is advantageously employed. According to the invention, said crosslinking is used with the charged binder or not, coated on at least one face of the porous element. The charges are thus integrated in the alveolar element. One will obviously make sure to use a binder with such a nature and in amounts so that it fixes any charges that it encloses without substantially altering the mechanical properties (elasticity, strength) of said porous element.

As will already be understood, said binder can be charged or not. By means of the hardness, shapes and amount of dry binder and any charges that it encloses, it is possible to control the sought scouring force.

As regards the nature of the charges that can be used, it is not original in itself. Any type of charge ordinarily used in the field of scouring is suitable. Advantageously, when strong scouring capacity is sought, even abrasive capacity, inorganic (mineral) charges will advantageously be used, like particles of alumina, silica, calcite. When cleansing, nonabrasive capacity is sought, synthetic (organic) charges will advantageously be used, like particles of polyethylene terephthalate (PET), polymethylmethacrylate (PMMA), polyurethane (PU) ...

The relief pattern(s) of the porous elements according to the invention does (do) not have sharp edges at the tip. It (they) can have sharp angles at the base.

Said pattern(s) according to the invention is/are generated by actual compression of the charged or uncharged porous material. This is explained in detail below. The rupture and tear strength of the porous element can be reinforced in this way. The fact that this result is not obtained with the methods of the prior art, as described in documents FR-A-2 302 711, FR-A-2 340 711 and FR-A-2 347 913 is emphasized here; processes, according to which patterns with sharp edges are generated by removing material (elimination of the material by cutting or volatilization).

According to a preferred variant of the first object of the invention, the element made of porous material has two so-called work faces, essentially parallel to each other, and only one of said two faces is profiled according to the invention. The relief pattern(s) thus exist(s) on a

single face of a sponge cloth or textile, or on a single face of a larger surface of a block of foam or a sponge that has an essentially parallelepipedal shape.

Generally, the relief pattern(s), which present(s) the characteristics developed above, occupy/occupies 30 to 95%, advantageously 60 to 90%, of the face on which it (they) is/are found. It/they is/are advantageously found on a consequent percentage of said work face, to the extent that it/they enclose(s) the active material: the scouring composition. It is ruled out, because of the structure of the porous element mentioned in the preamble, that it/they cover(s) said surface entirely. In fact, it is particularly advantageous that the zones separating a number of patterns represent a nonnegligible percentage of said surface. Because of said zones, the efficiency of the porous element is improved: water and detached dirt are more easily evacuated by better circulation of said water.

Moreover, said patterns, separated from each other by zones, are advantageously regularly distributed on the work face on which they are found; this is done for reasons of efficiency of the finished product, simplicity of its manufacture, and also for reasons of esthetics.

As regards the shape of said pattern(s), it can be almost any shape. It is obviously related to that of the recesses of the thermoforming tool. Said "rounded" pattern(s) can thus have a circular, square, rectangular, triangular, lozenge, star base, etc.

As regards the dimensions, it is easily understood that there are far fewer constraints for the dimensions of the base than for the height. The higher the pattern, the more fragile it is. It is appropriate to keep it solidly anchored. One generally assumes that said height (H) must satisfy the following formula relative to the smallest dimension of the base (L) (L = diameter of a circle, width of a rectangle, etc.):

$$H \leq \frac{L}{2}$$

As the reader will understand on reading the aforementioned, it is possible to find, on at least one of the work faces of the element of the invention:

- a single-piece relief pattern "apparently" positioned on an almost smooth surface (essentially devoid of pores);

  or

- a number of relief patterns, separated from each other by zones having an almost smooth surface (essentially devoid of pores). Said patterns can extend longitudinally over the entire said work face and thus form groups of ribs, monoblocks of great length. According to another variant, said patterns exist in larger numbers, detached from each other, surrounded by zones almost devoid of pores, over the entire periphery.

Characteristically, the zone(s) not occupied by the relief pattern(s) has/have a densified structure almost devoid of pores. Its (their) surface, generally flat, is almost smooth at the end of thermoforming. Said surface is no longer porous: its pores have been essentially plugged during thermoforming. During said thermoforming according to the invention, there is no elimination of material, but combined fusion and compression of it at the level of said zone(s); which ensures, at least on the surface, real felting and real densification of the porous material. This felting, densification of the porous material is not without effect on the performances of the scrubbing element according to the invention.

The zones between the relief patterns, which are thus perfectly marked and no longer have a porous structure, are particularly effective during use of the scrubbing element for evacuation of water (or any other liquid) between the patterns and removal of dirt, with which said water might be loaded. Said dirt is not retained in the porosity of said zones, to the extent that it no longer exists (felting). The clogging phenomenon is no longer observed.

Evacuation of water, possibly loaded, is accomplished more easily, because said zones between the relief patterns are continuous and discharge on the edges of the profiled face of the element of the invention. This is a preferred variant of the invention.

In the context of this variant, one advantageously observes, on said face(s) having the relief patterns, zones between said patterns in several directions. Said zones intersect and discharge over all the edges of said face(s). They thus surround, over the entire periphery, each of the relief patterns.

A perfect grid is thus observed on the thermoformed face. Sinuous zones can have been generated in the same fashion between the patterns, etc.

Incidentally, it is noted here that the relief pattern(s) is/are found on at least one of the work faces of the porous element. They can be found on several faces. Blocks of foam or

sponge, rectangular parallelepipeds, for example, thermoformed on their six faces, on two opposite faces, on a single face, etc., all enter within the scope of the present invention.

The elements of the invention, as described above, constitute in themselves household tools, especially scouring sponges with high performance.

According to one variant of the invention, said elements are profiled (by thermoforming) on only one of their faces and counterglued on a support with the face opposite the profiled face. The assembly so formed – thermoformed porous element plus support – represents a scouring composite. Such composites form the second object of the present invention. It is not ruled out that, within the structure of the composites of the invention, a porous element profiled on several faces will be used, or several profiled porous elements are used, etc.

Said composites advantageously contain an element of the invention, counterglued on a support made of an alveolar material of the synthetic foam type or a cellulose product.

Composites, consisting of a sponge obtained by the viscose process, are particularly preferred according to the invention, on one face of which a profiled element according to the invention is counterglued, made of a synthetic foam or woven or nonwoven textile (said element is integral with said sponge through its face opposite the profiled face).

The products of the invention – porous elements themselves and composites incorporating them in their structure – are particularly useful. Their performances result from the intrinsic characteristics of said porous elements, characteristics inherent to thermoforming of their surface coated with the scouring composition.

It is stated here that generally thermoforming, by generating the relief pattern(s) and zone(s) as described above

- improves, in particular, the elasticity, flexibility of the porous element;
- improves its rupture strength and tear strength. In the case of nonwovens, an improvement in wear resistance is also observed by a reduction in the phenomenon of pilling of fibers (said phenomenon is described below: during use, by friction of the element on the surface being cleaned, the fibers break and roll up on themselves, generating small balls ...);

(one will note here that the combined increase of these two properties (solidity and flexibility) is somewhat unexpected)).

- improves its use performance (facilitated evacuation water between the relief pattern; no clogging from dirt between said patterns),
- does not alter the scrubbing characteristics (dirt removal capacity, durability), but even improves them. An improvement of durability is noted, in particular, with the textiles of the invention charged with an abrasive composition.

Said thermoforming or thermoembossing will be taken up below. It represents a key step of the method for preparation of the porous elements according to the invention.

Said method can be used according to different variants. Two of said variants that form the third object of the present invention will be described in greater detail below.

According to the first, said method comprises:

- preparation of a scouring composition based on a possibly charged binder,
- coating of at least one of the faces of the element made of porous material with said composition;
- treatment of said coated element to fix said composition on it;
- thermoforming of (at least one of) face(s) so coated, to generate on said face at least one relief pattern without a sharp edge at the tip, presenting a porous structure charged at least superficially with said composition and at least one zone, having a densified structure essentially devoid of pores and charged at least superficially with said composition.

Preparation of the scouring composition is accomplished in the conventional manner. Adequate ingredients are employed: binder, possibly charged, and various additives of the catalyst, dye, etc. type. A heat-activatable catalyst is advantageously used to avoid premature setting of said composition.

In a second step, at least one face of a porous element is coated, also in the conventional manner, with said composition. This coating can be carried out according to different techniques (with a doctor, roller, by padding, by transfer, by printing, by spraying, by powdering on a presized, preimpregnated substrate or on a crude substrate (said powdering then being followed by treatment for fixation of the powdered product)) and according to several variants. The

second step can include a single coating, double coating, coating preceded by impregnation. In any event, a sufficient amount of scouring composition is deposited. Preimpregnation, generally in bulk of the porous element, can be judicious, even obligatory. It advantageously ensures consolidation of said porous element and/or its coloration. Such preimpregnation, as indicated above, can be used to impart the capacity to be thermoformed to said porous element (or to improve it).

In a third step, the scouring composition is made integral with the porous element. This integration can be accomplished by drying of said composition, by its crosslinking, by cooling of a molten polymer. When energy supply is necessary (especially to produce crosslinking), said energy can be supplied in the form of calories (heat treatment), in the form of UV, IR, HF, microwave radiation, X-rays, electron bombardment. The reactions involved can be accelerated by catalysis. By integrating said composition in the porous element, scouring characteristics are imparted to it.

It is noted here that this third step of integration of the scouring composition in the porous element can be conducted together with the fourth step of thermoforming under the obvious hypothesis where said integration can be obtained by heat treatment.

At the end of these three steps, an element made of porous material is obtained, at least one of whose faces is coated uniformly with a scouring composition. Such products are usable in themselves and are found in commerce. A process for preparation of such products is described, in particular, in Patent US-A-4 264 337.

According to the invention, characteristically one adds to these three steps a fourth thermoforming step.

It is suitable to create on the face already made scouring at least one relief pattern, as define above. Said pattern is obtained by applying, on said face while hot, a plate perforated with appropriate recesses and increasing the pressure of said application to a given value, which depends on the nature and thickness of the element so treated. The pressure is maintained with a time interval necessary for irreversible appearance of the surface pattern(s). Such thermoforming generates rounded pattern(s) and ensures felting with densification of the surface of the zone (zones) not occupied by said pattern(s).

The parameters (pressure, temperature, time) of such thermoforming are to be optimized by one skilled in the art to obtain the expected result. This optimization poses no particular

problem. Said parameters obviously depend on the nature of the porous base material and the type of scouring composition with which it is coated.

Said thermoforming advantageously modifies, as described above, the surface structure of the porous element.

This variant of the process of the invention is advantageously used with porous elements coated with a scouring, nonabrasive composition. In effect, to the extent that said coated element is thermoformed according to said variant, the presence of abrasive particles can cause a deterioration in the thermoforming tool.

According to the second variant, the scrubbing element of the invention is obtained by a process comprising:

- preparation of a scouring composition based on a possible charged binder;
- thermoforming of at least one of the faces of an element made of porous material (of the alveolar material or textile type) to generate on said face at least one relief pattern without a sharp edge at the tip, presenting a porous structure and at least one zone having a densified structure, essentially devoid of pores;
- coating of at least one of said thermoformed faces or thermoformed face with said composition;
- treatment of said coated thermoformed element for fixation of said composition on it.

It is understood that this process differs from the previous one by the order of the different steps, and especially by inversion of the order of the coating and thermoforming steps.

According to this second variant, the porous element is thermoformed on one or more of its faces not coated with the scouring composition. In the context of this variant, it is noted that treatment of the coated element for fixation of the scouring composition is obligatory. For details concerning the products employed (scouring composition) and the techniques (coating, thermoforming) in the second process, the above description of the first step is referred to.

This second process (second variant) is advantageously used for preparation of a profiled porous element charged with an abrasive composition.

The element so obtained, thermoformed on at least one of its work faces, is used as such or incorporated in the structure of a composite. The process for preparation of such a composite represents the last object of the present invention.

It comprises in succession:

- preparation of a thermoformed element, as described above;
- countergluing of said element through one of its nonthermoformed faces on a support.

Said countergluing employs a technique and a material (glue) familiar to one skilled in the art.

The invention is illustrated by the following examples and the accompanying figures. Figure 1 shows a perspective view of a cleaning composite according to the invention.

Figure 2 shows a partial cross section along II-II of said composite on a larger scale.

Said composite comprises a profiled element 1 counterglued on a sponge 2. Said element 1 has on its face 1' opposite its face 1", counterglued on sponge 2, relief patterns 3, separated by zones 4. Said face 1' was coated with a scouring composition. Said patterns 3 are shown only on part of said face 1'.

The specifics of element 1 according to the invention are readily apparent in Figure 2. The relief patterns 3 have preserved a porous structure and do not have a sharp edge at the tip. They are charged with scouring particles and/or abrasive particles (not shown) over a thickness e. The zones 4 denser than patterns 3 have an almost flat and smooth surface, generated by thermoforming. Said zones 4 are charged over a thickness e' (e' < e: result of thermoforming used before coating) with scouring and/or abrasive particles.

Example 1

A composite of the invention, as shown in Figure 1, is produced by using the process described above with the materials mentioned above.

Initially, an element according to the invention is prepared from a foam having two essentially parallel faces spaced by 10 mm (thickness of said foam). Said foam is a synthetic

open-cell foam (of small size) of the PU type. More precisely, it is an FL40 foam marketed by GIUSEPPE OLMO. It has a density of 40 kg/m^3.

Said foam is first impregnated throughout by padding with a mixture having the following composition (wt.%):

- prepolymer (single component polyurethane adhesive based on aromatic isocyanate, marketed by CECA under the name NOVAFLEX NM36) 70.95%
- polyol (linear polyether containing hydroxyl groups (about 3.4%), marketed by BAYER under the name DESMOPHEN 1600 U) 26.65%
- catalyst (heat-activatable, mixture of amine salts (1,8-diazobicyclo[5.4.0]undec-7-ene) and an organic acid, marketed by AIR PRODUCTS under the name POLYCAT SA-102/10) 0.42%
- dye (green, GREEN AM362, marketed by RICHARD FAPCO) 1.98%

For this impregnation, said mixture is used in an amount of 500 g/m^2 of foam. This impregnation colors said foam and simultaneously improves its strength and capacity to be thermoformed.

Said foam so impregnated is then coated with a doctor on one of its faces with a scouring composition resulting from a mixture of (wt.%)

- prepolymer (single component polyurethane adhesive based on aromatic isocyanate, marketed by CECA under the name NOVAFLEX NM36) 44.7%
- polyol (linear polyether, containing hydroxyl groups (about 3.4%), marketed by BAYER under the name DESMOPHEN 1600 U) 7.45%
- catalyst (heat-activatable mixture of amine salts (1.8-diazo-bicyclo[5.4.0]undec-7-ene) and organic acid, marked by AIR PRODUCTS under the name POLYCAT-SA 102/10) 0.20%
- dye (green, GREEN AM362, marketed by RICHARD FAPCO) 0.75%
- charges (polymethylmethacrylate, particles with a particle size between 250 and 500 µm) 20.85%

- charges (silica, particles with a particle size between 1 and 40 µm, marked by SIFRACO under the name MILLISIL C400) 26.05%

For this coating, said composition is used in an amount of 600 g/m^2 of impregnated foam. In view of the nature and particle size of the charges employed (polymethylmethacrylate particles) in said mixture, scouring, nonabrasive properties are imparted to the foam element. A nonscratching scrubbing is produced.

The small particles of silica intervene to controls the viscosity of the mixture.

The successively impregnated and coated foam is then heat treated (5 minutes at 105°C in a drying cabinet). Crosslinking of the prepolymer resulting from this heat treatment ensures fixation of the mixtures (impregnation and coating) in the foam element, especially fixation of the charges.

The foam so heat treated is then thermoformed on its coated face. A plate perforated with the desired pattern, brought to 225°C is applied at 20 bar for 1 minute to said coated face. The relief patterns are thus generated. Said relief patterns have the following dimensions:

$L \times l \times h$; $L = 12$ mm

$l = 6$ mm

h varying from 2 to 5 mm.

They are regularly distributed on the coated face. They cover about 80%. (The zones between the patterns have a width of about 1 mm).

A foam element, coated and profiled according to the invention, is thus produced.

In a second case, said foam element is counterglued on a sponge support about 20 mm thick. A scouring composite according to the invention is thus obtained.

The heat treated foam is tested before and after thermoforming.

The INSTRON test is used to measure elongation at break and rupture force.

The samples are samples 5 cm by 7 cm with variable thickness, depending on whether they were subjected to thermoforming or not.

The distance between edges is 5 cm. The width and length of stressing are therefore identical and equal to 5 cm.

The value of the rupture force is the value interpreted on the screen and is not related to the stress cross section (= thickness × width).

The obtained results are shown in Table 1:

	Test	Heat treated foam without thermoforming	Heat treated and thermoformed foam
Elongation at break (%)	INSTRON	125,2	270
Rupture force	INSTRON	70,5	135

These figures clearly show that thermoforming improves the elasticity and rupture strength of the sample.

An improvement, in any event, is obtained at the level of the mechanical properties, whatever the form and distribution of the patterns, to the extent that thermoforming densifies the foam regionally.

Moreover, it was verified that said thermoforming does not alter the scouring performances of the foam (dirt removal capacity, durability).

Example 2

2a

A nap of preneedled fibers, consisting of:

- 70 wt.% polyamide fibers of 17 dtex;
- 30 wt.% polyester fibers of 17 dtex

of 25 g/m^2 is impregnated with 50 g/m^2 of a mixture of acrylic latex and dye. This nonwoven is referred to as a substrate. This substrate of 300 g/m^2 has a thickness of 9 mm and a volume per unit weight of 30 cm^3/g. It is therefore very porous. Said substrate is thermoformed on one of its faces before coating. More precisely, said substrate (30 × 30 cm sample) is thermoformed in a press at 200°C under 50 bars for 1 minute. Thermoforming generates on its surface S patterns, as shown in Figure 1. Said patterns cover 80% of the surface of the thermoformed face. Said face so thermoformed is then coated by spraying with a scouring composition charged with

abrasive particles, then dried. The deposit after drying and crosslinking at 70°C is 200 g/m^2. It contains 50 g/m^2 binder, consisting of a formaldehyde-phenolic resin and 150 g/m^2 of abrasive charges of alumina and silica. The obtained element is called C1.

A sample of said substrate is not thermoformed (it has a "relief" according to the invention of 100%). One proceeds to coating and drying and crosslinking, as previously indicated. It represents a control T.

2b

Said substrate of example 2a is thermoformed by passage through a heating calender equipped with two steel heating rolls. The lower roll is smooth and kept at a temperature of 70°C. The upper roll is engraved with helicoidal grooves at 20° relative to the axis of the roll. These grooves form an undulation with a depth of 3.5 mm, whose rounded tips are regularly spaced by 11 mm. It is heated to 200°C. The 40 × 40 cm samples are introduced to the calender at 1 m/min under a linear pressure of 60 N/cm. The width of the lines or width of the densified zones is about 1.7 mm. The densified surface is about 15%. The relief surface according to the line pattern is therefore about 85%. The thermoformed samples are coated, dried and crosslinked, as indicated previously in example 2a. The obtained element is called C2.

2c

From the thermoformed substrates of example 2b, a scrubbing element C3 is prepared by second passage through a calender in a position shifted by 90°, followed by coating, drying and crosslinking stages, as described in example 2a. Lozenges in relief are thus created on the thermoformed face of said element C3. The relief surface according to said lozenge patterns represents about 73% of the surface of the thermoformed face. About 27% of said face was densified.

The abrasiveness and durability of the scrubbing elements according to the invention C_1, C_2 and C_3 and control T were evaluated by tests of the Taber type. Said samples, wetted beforehand, whose abrasive face is placed in contact with two aluminum rollers (each roller support is ballasted with a weight of 1.25 kg), rollers for which the weight was precisely

determined beforehand (to a tenth of an mg), are rotated at 1 revolution per second (rotational speed of the disk carrying said samples). A tachometer totals the number of rotations of said disk.

The abrasiveness of the tested sample is measured by the weight loss of said rollers after a specified number of rotations.

The durability is evaluated by determining the number of revolutions necessary to perforate the sample.

The results of abrasiveness, shown in Table 2, are expressed in weight loss (K in mg) of the aluminum rollers between the weight of the rollers before the test and their weight after the considered number of revolutions (N). The abrasiveness is expressed in mg/1000 revolutions (i.e., 1000 × K/N). The abrasiveness is determined after 500 revolutions (K 500), 1,000 revolutions (K 1,000), 1,500 revolutions (K 1,500) and 2,000 revolutions (K 2,000).

The rigidity of said elements C_1, C_2, C_3 and control T are also evaluated.

The rigidity is measured by placing 15 × 7 cm samples between two grooved plates by the compression force necessary to fold them width-wise. The grooves are 13 mm deep, open by 17 mm and 6 mm wide at the bottom of the groove. The rigidity or lateral compression force, expressed in newton, is the average of the measured rigidities on samples cut along the direction of movement and in the direction across the sample.

Table 2

	T	C_1	C_2	C_3
RELIEF	"100 %"	80 % (S)	85% (lines)	73% (lozenges)
Number of patterns per dm^2	0	120	9	82
Taber abrasiveness (mg/1,000 revolutions)				
K 500	226	384	269	370
K 1000	131	330	181	209
K 1 500	102	276	142	176
K 2 000	86	244	120	156
Abrasiveness between 1,000 and 2,000 revolutions				
in mg	41	158	59	103
Taber durability				
N (revolutions)	1 750	>2 000	2 000	>2 000
Rigidity				
(N)	11,7	7,8	7,5	9,5

This table shows that the elements according to the invention are more abrasive and more durable, and that it is suitable to multiply the number of patterns: the rigidity is reduced, which indicates that the flexibility is improved.

Claims

1. Single-piece scrubbing element (1) made of a thermoformable porous material of the alveolar or woven or nonwoven textile type, having at least one relief pattern (3) on at least one (1') of its so-called work faces (1', 1"), which occupies only part of the surface of said face (1'), characterized by the fact that said relief pattern (3), without a sharp edge at the tip, has a porous structure, charged at least superficially with a scouring composition, whereas the surface of said face (1') not occupied by said relief pattern (3), defining at least one zone (4), has a densified structure, essentially devoid of pores, charged at least superficially with said scouring composition.

2. Element (1) according to Claim 1, made of an alveolar material of the synthetic foam type or cellulose product.

3. Element (1) according to Claim 1, made of a woven or nonwoven textile based on synthetic, natural and/or artificial fibers.

4. Element (1) according to any of the Claims 1 to 3, characterized by the fact that said scouring composition contains mineral or organic charges.

5. Element (1) according to any of the Claims 1 to 4, characterized by the fact that it has two so-called work faces (1, 1") essentially parallel, only one (1') of said two faces (1', 1") having at least one relief pattern (3).

6. Element (1) according to any of the Claims 1 to 5, characterized by the fact that said pattern(s) (3) covers/cover from 60 to 90% of the face (1'), on which it/they is/are found.

7. Element (1) according to any of the Claims 1 to 6, characterized by the fact that said zones (4) between said patterns (3) are continuous and end at the edges of said face (1').

8. Element (1) according to any of the Claims 1 to 7, characterized by the fact that said zone (4) between said patterns (3) intersect and end on all of its edges.

9. Scouring composite, characterized by the fact that it comprises an element according to the invention 1 to 8 – advantageously an element made of synthetic foam or woven or nonwoven textile – counterglued on a support (2) made of an alveolar material of the synthetic foam or type or a cellulose product – advantageously on an artificial sponge.

10. Process for preparation of element (1) according to any of the Claims 1 to 8, characterized by the fact that it comprises:

- preparation of a scouring composition based on a possibly charged binder;

- coating of at least one (1') of the faces (1', 1") of an element made of a porous material with said composition;
- treatment of said coated element for fixation of said composition on it;
- thermoforming of at least one (1') of said coated faces (1', 1") or of the coated face (1'), to generate on said face (1') at least one relief pattern (3) without sharp edge at the tip, having a porous structure charged at least superficially with said composition, and at least one zone (4) having a densified structure essentially devoid of pores, charged at least superficially with said composition.

11. Process for preparation of an element (1) according to any of the Claims 1 to 8, characterized by the fact that it comprises:

- preparation of a scouring composition based on an optionally charged binder;
- thermoforming of at least one of the faces of an element made of a porous material, to generate on said face at least one relief element without sharp edge at the tip, having a porous structure, and at least one zone, having a densified structure essentially devoid of pores;
- coating of at least one of said thermoformed faces or the thermoformed face with said composition;
- treatment of said coated thermoformed element for fixation of said composition on it.

12. Process according to any of the Claims 10 or 11, characterized by the fact that coating with the scouring composition is preceded by bulk impregnation of the crude or thermoformed element.

13. Process for preparation of a composite according to Claim 9, characterized by the fact that it comprises in succession:

- preparation of an element (1) according to any of the Claims 10 to 12,

- countergluing of said element (1) by one (1") of its nonthermoformed faces, on support (2).

Figure 1

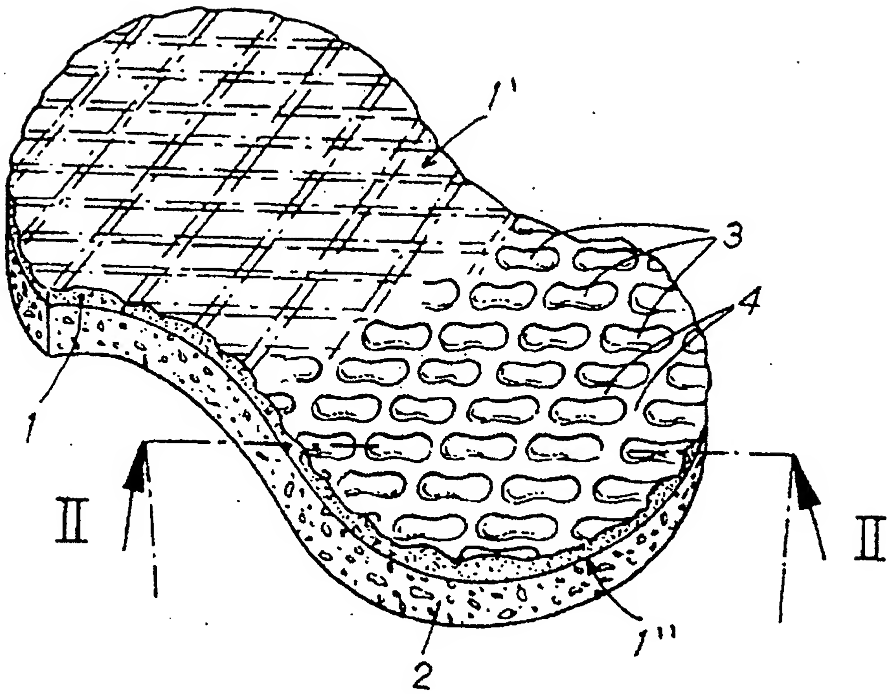
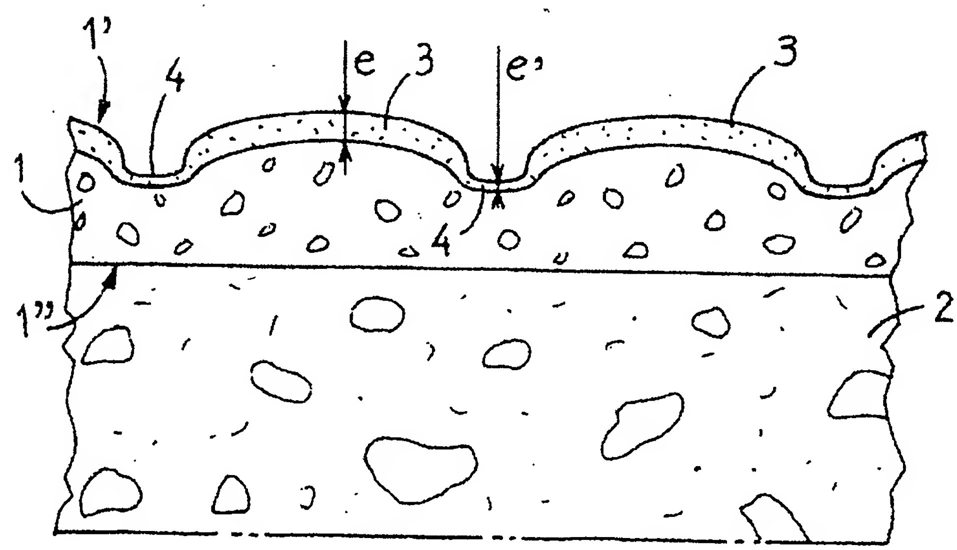


Figure 2



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EUROPEAN RESEARCH REPORT

Application Number
EP 95 40 1876

RELEVANT DOCUMENTS

Category	Citation of document with indication to the extent possible of the relevant passages	Relates to Claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.6)
A	US-A-3 080 687 (M.H. GROSS) * the complete document *	1	A47L13/16
A	US-A-2 835 911 (R.S. MAHMARIAN) * the complete document*	1	
A	DE-U-86 25 683 (A. DESCHNER) * page 8 – page 9; figures*	1	
A	EP-A-O 222 955 (SPONTEX SA) * claims 1-5; figure 7*		
A	FR-A-2 434 224 (MINNESOTA MINING & MFG CY) * claims; figures*	1	
A	US-A-4 111 666 (H. KALBOW) *the complete document*	1	
A	FR-A-2 355 946 (CARL FREUDENBERG) *claims; figures*	1	
A	WO-A-91 01217 (WEYERHAEUSER CY) *summary; claims; figures* - - - -	1	
			SUBJECT AREAS RESEARCHED (Int. Cl.6) A47L

The present research report was prepared for all patent claims

Research site	Date research completed	Authorized officer
THE HAGUE	October 19, 1995	Vanmol, M

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